



# TC3 Workshop: Cognitive Elements of Effective Collaboration.

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## Theater Assessment Profiling System (TAPS) Contribution to Coalition Collaboration

**Briefing on an advanced visualization scheme powered  
by a state space “engine” process in support of shared  
situation awareness, collaboration, and decision making**

Dr. Marco Fiorello and Michael Welch, CHFP  
SYS – San Diego Operations, C4I Division  
9620 Chesapeake Drive, Suite 201  
San Diego, CA 92123  
Phone (858) 715-5500 extensions 329 and 506

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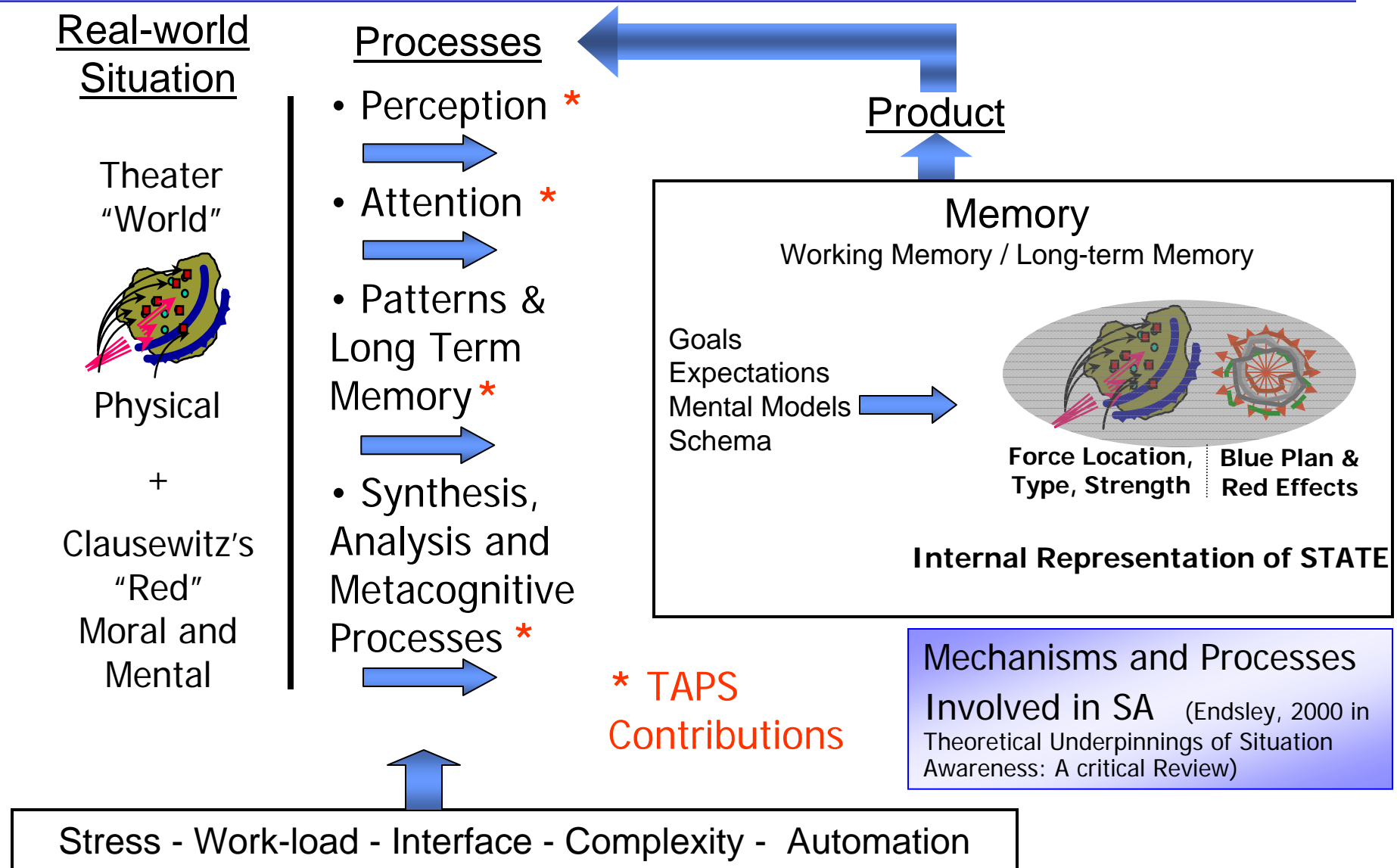
# Overview

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- Effective SA in a JTF
- Definitions
- Goal of TAPS Contribution to Collaboration
- VSS “Under the Hood”
- Global War Game 2001 TAPS
- Situation Assessment
- Experimental Design
- Prototype and Top Sight™
- Summary



# Requirements for Effective SA in a Joint Task Force (JTF) Setting





# Descriptions of TAPS & VSS

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- **TAPS – Theater Assessment Profiling System-** An Effects-Based Operations (EBO) visualization that provides:
  - Commander's single view of his critical information environments as they progress, stagnate or fail (retrograde).
  - A high-level integrated view with "tailorable drilldown" enabled the commander to focus on normally disparate activities in the battlespace.
  - Explicit adversary and friendly (joint/coalition) EBO depictions
- **VSS – Valuated State Space™** - A model utilizing multi-attribute utility theory that:
  - Mathematically captures the commander's intent, the desired effects on the enemy and unintended consequences for his planning-to-execution domain.
  - Incorporates the commander's priorities
  - Fuses and normalizes objective metrics and expert subjective data
  - Defines objectives using measures of effects
  - Defines measures of performance with intervals of achievement

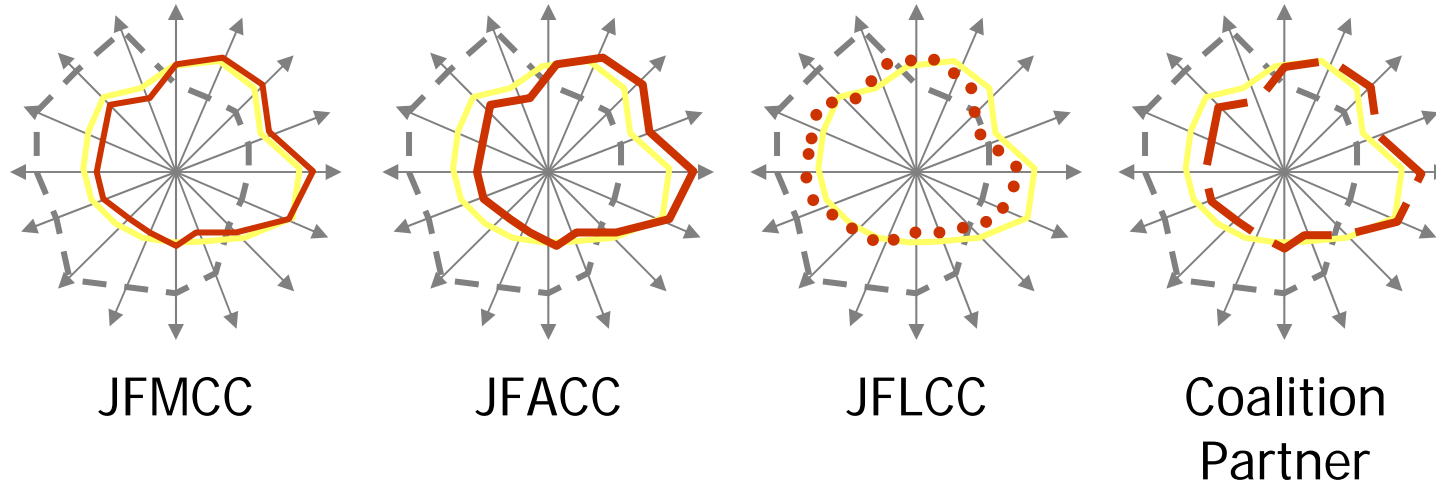


# Goal of TAPS Contribution to Coalition Collaboration

## TAPS Contribution to Coalition Collaboration

- Facilitates collaboration between elements by highlighting differences in team SA between the major elements, such as, JFMCC, JFACC, JFLCC and coalition partners
- Visualizes situation assessment of joint/coalition high-level purpose and achieved effects on the enemy
- Provides access to lower level details for further specification of differences

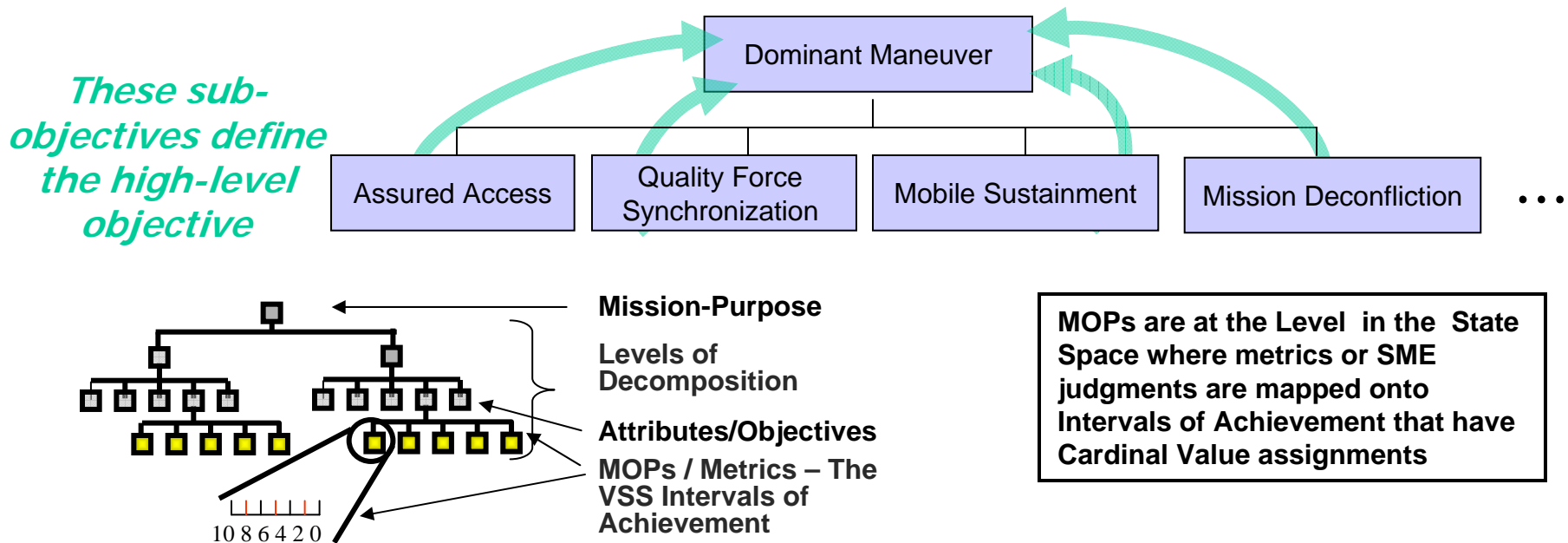
### TAPS-VSS Environments Components and Coalition





# VSS™ Functionality -“Under the Hood”

- **Decomposition** of an objective into lower-level, more detailed sub-objectives



- **Operational Environment**: Objectives must be useful to be meaningful to the decision-maker. Objectives should facilitate explanations to others.
- **Completeness**: A set of subobjectives, i.e. the state space, is complete if it is effective in indicating the degree to which the overall objective is met.
- **Non-redundancy**: Objectives in the Valuated State Space should be preferentially distinguishable

\* Hierarchy of Objectives from *Decisions with Multiple Objectives: Preferences and Value Tradeoffs* by Keeney and Raiffa



# VSS Under the Hood

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## Key Characteristics

Subject Matter Expert inputs for:

- Determining mission-purpose
- Constructing the state space
- Determining “importance weight” of each objective/attribute
- Establishing the achievement / assessment criteria and numeric cardinal value assignments, i.e., utilities.
- Defining intervals of achievement for Measures of Performance (MOPs) through which utility values are assigned

Logic engine that produces values for the TAPS display

Mathematical/Computational Normalization Process

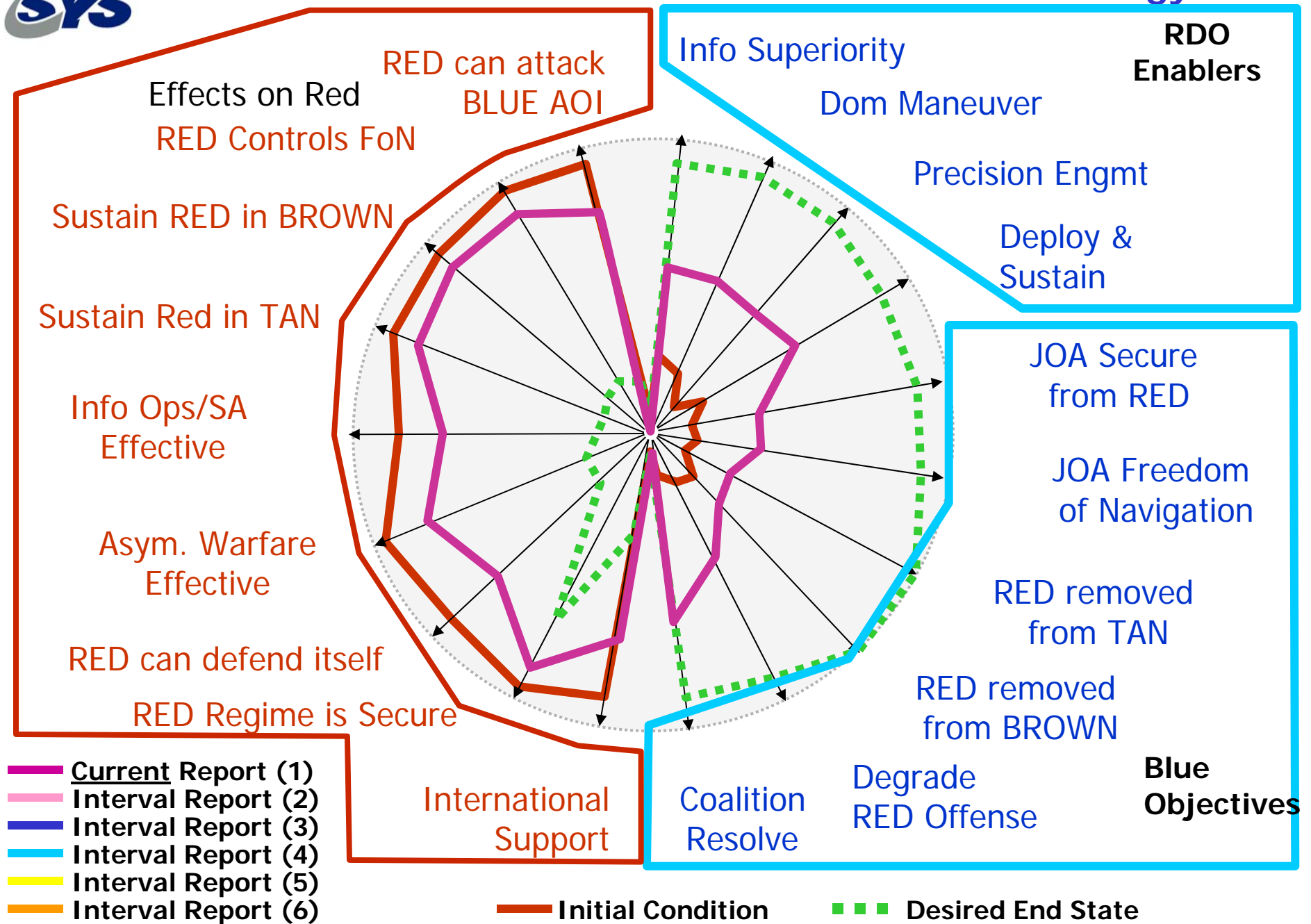
- Arithmetic & geometric means and default thresholds
- Future Research: Incorporation of other data sources, NSS
- Future Research: Evolutionary computation, fuzzy logic, etc.

What is needed to operate the TAPS-VSS model?

- Context
- Mission-Objectives (CCIRs,)
- SMEs
- Calibration of SMEs at MOP level
- Maintain Calibration of SME Population

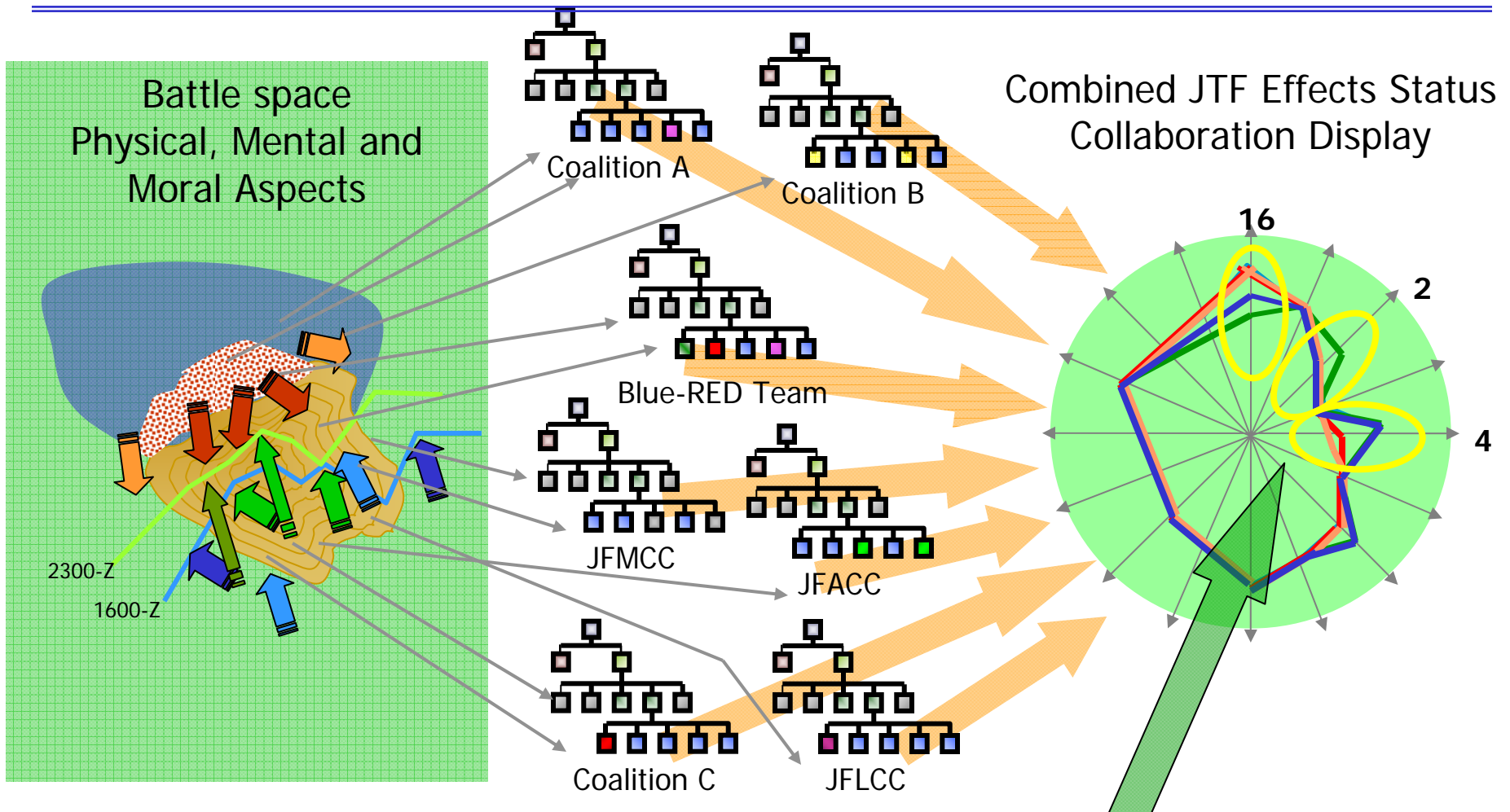



# GLOBAL 2001 – TAPS – Effects on RED & BLUE Strategy





# Situation Assessment Deltas Identified and Highlighted by Major JTF Element



- Data collected for major elements shown in Combined Display
- Yellow  Show Deltas in Situation Assessment by High-level purpose
- Drill down into Vectors 16, 2 and 4 will disclose details



Drill Down to  
Second level  
MOEs

## High-Level Display

### BLUE ACCESS ASSURANCE

RED ANTI-ACCESS  
AND OFFENSIVE DEPTH

RED MILITARY  
WILL TO FIGHT

RED C2-C4ISR  
STABILITY

KORU  
POLITICAL  
RESOLVE

CYBERSPACE  
ACCESS

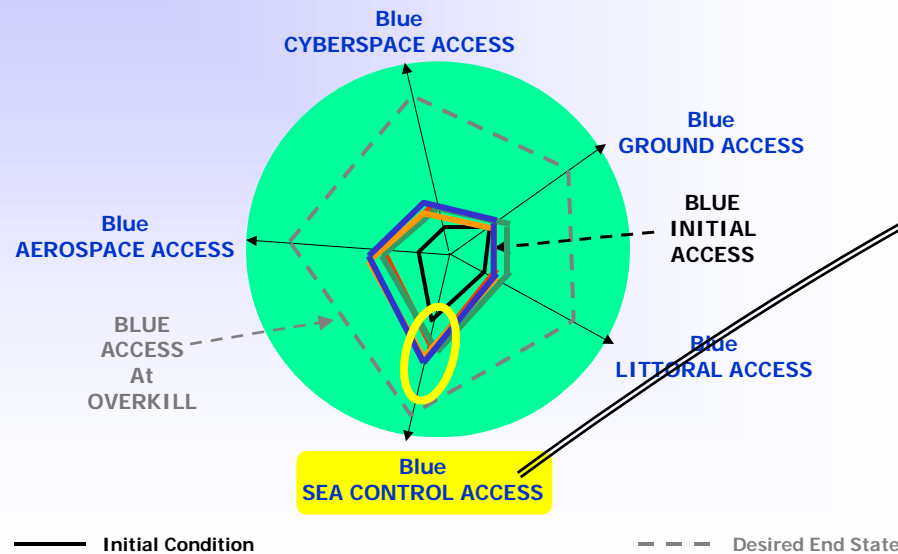
BLUE'S FON

BLUE CRITICAL  
RESOURCES

BLUE-COALITION  
POL-MIL STABILITY

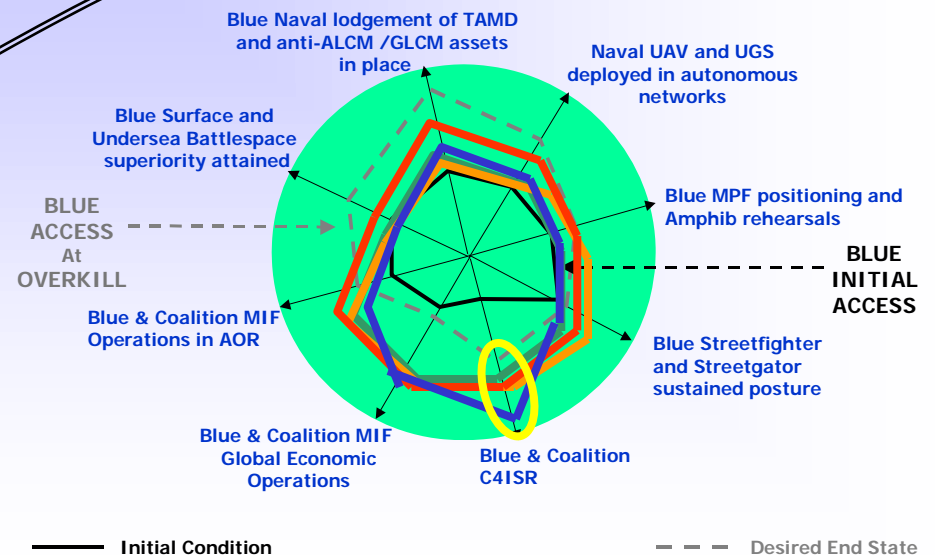
KORU  
RESOLUTION

### Blue Access Assurance Vector Second Level Nesting of TAPS-VSS Display



Drill Down to  
Third level  
MOEs/MOPs

### (Blue Access Assurance) -> Sea Control Access Third Level Nesting of TAPS-VSS Display



Level 2 SA – Comprehension  
Enabled by Detailed Views of MOE's



## 2x2 Experimental Design

Innovative Concept to Enhance JTF & CTF Collaboration

	Training	Trial I		Trial II	
Treatment A TAPS-VSS	1. Experiment set-up, org., process, scenario, etc. 2. Treatment technologies 3. Schedules 4. Debrief Questionnaires	Situation Briefs CG Scenario	Debrief	Situation Briefs CG Scenario	Debrief
Treatment B TBD		Situation Briefs CG Scenario		Situation Briefs CG Scenario	

- Teams of Component/Coalition Commanders

1. JFMCC
2. JFACC
3. JFLCC
4. Coalition Country A
5. Coalition Country B

- Data Collection

1. Questionnaires
  2. Debriefings
  3. Observations
  4. Situation Awareness probes
- ✓ Cobra Gold 02
  - ✓ FBE-J

- Success Criteria

1. Improved Situation Assessments for Components/Coalition
2. Identification of specific "CCIR Deltas" in Situation Assessment between JTF Elements
3. Improved collaboration



# TAPS-VSS Prototype

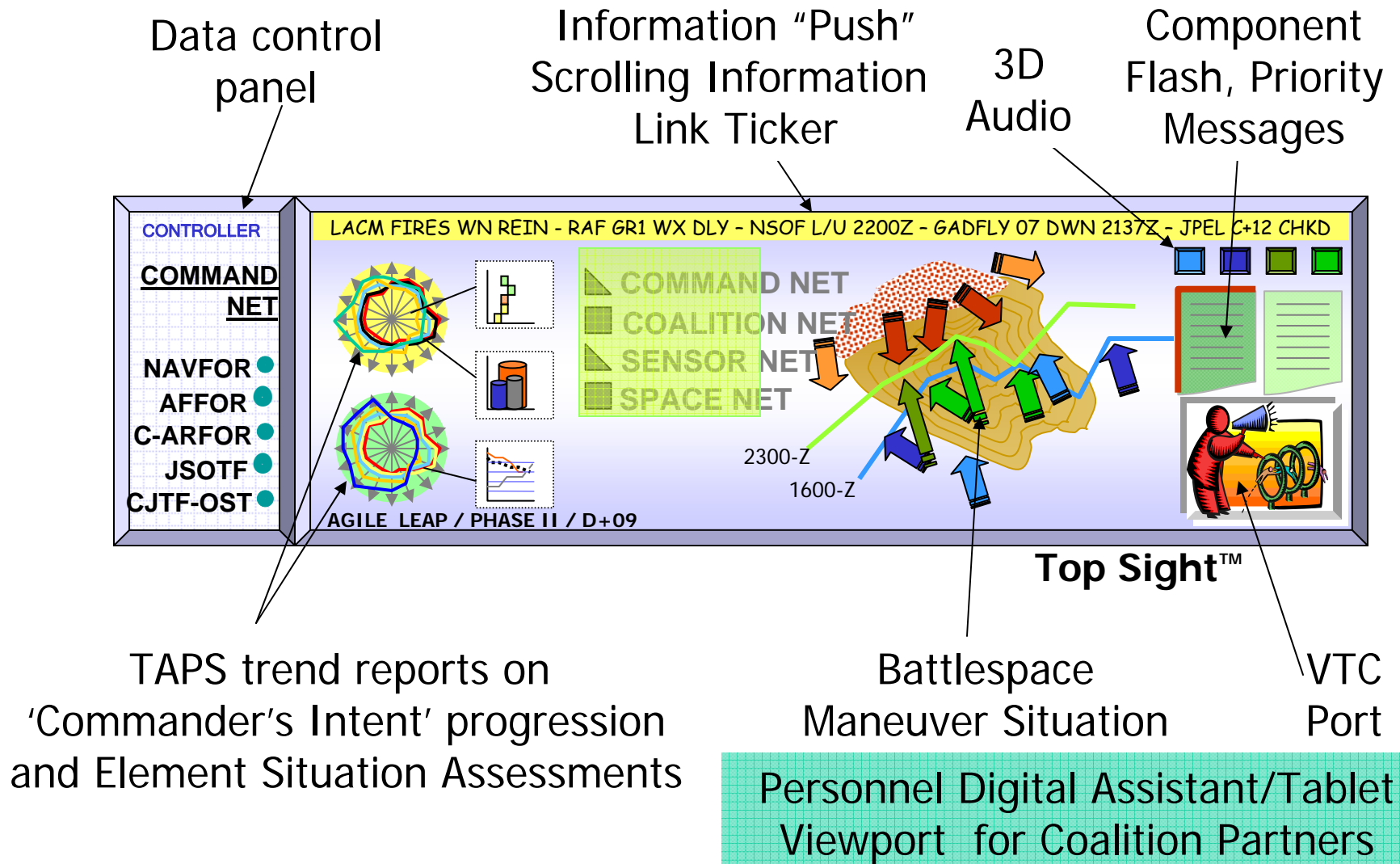
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- TAPS Prototype Events
  - Global Wargame 2000 (August) & 2001 (July)
    - The VSS metrics construct was validated as an appropriate way to track disparate topics relevant to the commander
    - TAPS as a prototype visualization provided both a high level roll-up assessment of input data and illustrated trend progression, stagnation or retrograde
  - US Joint Forces Command Presentation LOE – July '01
    - Formal Report due Dec 01
- Scheduled Events
  - Cobra Gold 02 – Attended USPACOM Joint Mission Force PC and CG02 IPC and MPC. Attending FPC in mid Jan 2002.
  - Fleet Battle Experiment Juliet – Attended IPC/MPC



# Top Sight™

## Command Information Viewport



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